



Preservation Protocol for Trimmed Tender Coconut

R. Pandiselvam, M.R. Manikantan, Shameena Beegum, A.C. Mathew,
S.V. Ramesh, Murali Gopal and K.B. Hebbar

ICAR-Central Plantation Crops Research Institute, Kasaragod – 671 124, Kerala, India

Consumers generally prefer highly nutritious drinks in the form of 'ready to serve' and as a soft drink in bottles or as tetra packed beverages. Tender coconut is a noble gift of nature and the recent health awareness among the consumers has revitalized its importance as a drink of choice. Minimal processing technique for tender coconuts is being developed in response to huge demand from North America and Europe, and thus provides an opportunity for the Asia – Pacific nations to boost the income of coconut growers, farmer producer companies and tender coconut processing industries.

The tender coconut comprise an exocarp (skin), mesocarp (composed of a fibrous husk), and an endocarp (shell) that encloses the kernel (flesh) and juice. Raju et al. (2002) reported that the average weight of tender coconut is 1.5 kg of which husk

“ Across regions, across lifestyles, across borders, Tender coconut is the one taste that binds all. A pure, healthy, natural drink that helps us get healthy and stay healthy. ”

weight constitutes about 65% of the total weight. Even though the tender coconut husk acts as an insulator for coconut water, it is bulkier and increases the cost of transportation and packaging. The bulky nature of tender coconut can be reduced by trimming out the husk to leave it as two-third of the original weight. A minimum of 20–35% of the coconut weight can be reduced by performing trimming operation (Pandiselvam et al., 2019). Trimmed tender nuts are prepared by trimming/shaving of the husk to the maximum possible level, without damaging the shell. This not only ensures considerable reduction in the ratio of weight/volume of the nut but also results in an attractive look (diamond/pentagonal shape). Nevertheless, browning and mold development in the nuts following the trimming process requires to be controlled with careful use of chemical solution without contaminating the kernel and the water. This article discusses the various preservation protocol/methodologies of the trimmed tender coconut that are available to ward off the chemical and microbial contamination.

Preservation protocol:

The following procedures are generally followed to preserve the trimmed tender coconut.

1. Harvesting

For shaping/trimming the nuts, it is important to ensure that the maturity of tender coconut is greater than or equal to 6 months. Mohpraman and Siriphanich (2012) found that the sodium metabisulfite (SMS) residues were higher in the edible portions of the trimmed younger coconut (less than 6 months old) treated with SMS solution than in matured nuts. Also, care must be taken while harvesting the tender coconuts to prevent them falling to the ground. Presence of cracks on the surface of tender coconut husk will enhance the enzymatic activity. Also, there is a possibility of development of cracks on the tender coconut during handling and storage due to high pressure of the water inside.

2. Surface sterilization

Tender coconuts have a high microbial load on its surface, especially those left on the ground after harvesting and transported over long distances. FAO (2007) recommends that the whole tender coconuts are washed in potable water to remove dirt and soil. Sanitizing the nut in a dilute bleach solution further reduces the number of microorganisms and

postharvest diseases on the surface of the tender coconut.

3. Trimming

Shaping of the tender coconut has been done by using either semi-automatic mechanical trimming machine (approximate cost: Rs. 1.2 lakhs) or fully automatic air compressor based trimming machine (approximate cost: Rs. 2.5 lakhs). The capacity of the fully automatic trimming machines varies from 4-6 nuts/min, whereas semiautomatic machine has the capacity of about 1 to 2 nuts/min. In some places, lathe machine has been used for trimming the tender coconut. But the capacity of the lathe based trimming was only 21 nuts/h, which is lower than manual trimming (40 nuts/h) (Jarimopas and Ruttanadat, 2007). ICAR- Central Plantation Crops Research Institute (CPCRI), Kasaragod, has developed the linear actuator-based vertical trimming machine for tender coconut processing. The license for the fabrication of the ICAR-CPCRI developed trimming machine was transferred to one machine manufacturer and the interested machine fabricators/entrepreneurs can approach ICAR-CPCRI for license. The cutting energy required to trim the different genotypes of tender coconuts has been analyzed and reported (Pandiselvam et al., 2020). The trimmed tender coconut has a flat bottom, cylindrical body, and conical top. Care must be taken to avoid over-trimming around the eyes, as the tender nut has internal water pressure causing the eyes to burst. Mohpraman and Siriphanich (2012) recommended that the trimming process should allow at least 1 cm thickness of the husk left on the stem end of the fruit over the soft eye. Otherwise, the chemicals used as anti-browning solution may penetrate the edible portion/water via the soft eye.

4. Dipping in chemical solution

The trimmed tender coconuts must be treated with anti-browning solution to control the activity of enzymes such as Polyphenol Oxidase (PPO) and Peroxidase (POD).

- CPCRI Technology- ICAR-CPCRI developed a technology for preservation of trimmed tender coconuts and the technology has been commercialized to two entrepreneurs. Application of combination of organic acids, chelating agents and resorcinols were found to be more effective in preventing the browning of trimmed tender coconuts.

- KAU Technology- Trimmed tender coconuts are treated with the solutions of 0.5% potassium metabisulphite (KMS) and 0.5% citric acid for three minutes (Raju et al., 2002).

- In Thailand – The trimmed tender nuts are dipped in 1 to 3% sodium metabisulphite (SMS) solution for 2 to 5 min and then wrapped in plastic film to prevent the enzymatic browning (Tongdee et al. 1991).

Mohpraman and Siriphanich (2012) recommended the SMS concentration of $\leq 5\%$ for ≤ 5 min dipping. Increase in the SMS concentration and dipping time resulted in penetration of SMS in the nut's interior via air channels in the husk and through the soft eye.



5. Surface drying

It is recommended to follow the shade drying immediately after dipping the nuts in anti-browning solutions to avoid the superficial mold growth on the surface of the trimmed wet coconuts.

6. Shrink wrapping

The trimmed nuts are packed in either 0.025 mm thick LDPP or 0.023 mm thick LDPE covers having 40 ventilation holes (Raju et al., 2002). In Thailand, the trimmed nuts are wrapped with polyvinylchloride (PVC) film (Mohpraman and Siriphanich, 2012).

7. Storage

Trimmed tender coconut treated with 2% SMS has been stored for 3 to 4 weeks under refrigerated storage (3 to 6°C with 90 to 95% RH) and can be

stored for 2 to 7 days at ambient temperature (Paull and Ketsa, 2015). The concentration of 0.5 to 1.0% SMS will extend the shelf life of trimmed nut up to 2 days under ambient temperature (Paull and Ketsa, 2015). The nuts treated with 0.5% KMS and 0.5% citric acid can be stored for 26 days under refrigerator condition (5 ± 7 °C). The CPCRI developed solution will enhance the shelf life of trimmed tender coconut 4 to 6 weeks under refrigerator condition. In general, the refrigerated condition would be safe for the storage of trimmed nuts.

8. Transportation

The trimmed nuts are packed in single-piece cartons containing 6 to 16 each (Paull and Ketsa, 2015) and transported to the desired places. Also, the product can be packed in plastic crates and insulated chill boxes for transporting and storage. ■

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